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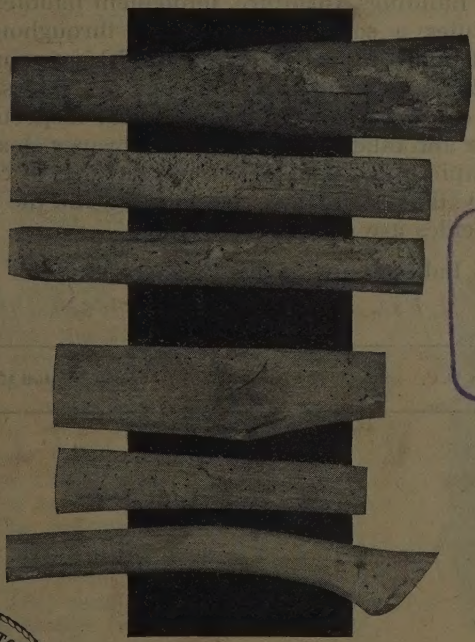
U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1477

PREVENTING DAMAGE BY LYCTUS POWDER-POST BEETLES



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POWDER-POST damage to lumber, the woodwork of buildings, furniture, implement handles, etc., constitutes a serious annual loss throughout the United States to our rapidly diminishing supply of available hardwoods. As this bulletin shows, such losses can be prevented by periodical inspection of lumber and other hardwood stock, proper classification, rapid utilization, and the application of certain preservative treatments. Kiln drying and the use of insecticides are effective remedies.

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PREVENTING DAMAGE BY LYCTUS POWDER-POST BEETLES

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INJURY AND HABITS

LYCTUS powder-post beetles (fig. 1) cause extensive losses to the seasoned sapwood of hardwood lumber, implement handles, furniture, etc., especially ash, hickory, and oak. Damage of this type is distributed widely throughout the world, for many species of these beetles are carried from one country to another in the commercial products which they infest. No species of hickory is immune to attack, nor is ash from the Northern States more resistant to attack by Lyctus beetles than ash grown in the South.

Fig. 1.—Winged adult of a powder-post beetle, *Lyctus planicollis*. Greatly enlarged

The winged adult beetles lay their eggs (fig. 2) in the pores of the wood, and the larvæ or grubs (fig. 3) which hatch from them burrow through the wood and reduce the fiber to a flourlike powder (figs. 4 to 9). The different kinds of Lyctus beetles vary somewhat in their habits and seasonal history, but there is a general similarity. They pass the winter as larvæ in the wood, change to pupæ (the resting stage) in early spring, and in late spring and early summer the adult beetles emerge from the wood and fly about. Under natural out-of-doors conditions the eggs are laid in the pores of the wood soon after activity commences in the spring; but in storehouses, sheds, or buildings kept warm and dry the development may take place and the eggs may be deposited much earlier.

PREVENTION OF ATTACK

INSPECTION, CLASSIFICATION, AND RAPID UTILIZATION

The adoption of the following system of periodical inspection, classification, and rapid utilization of the older seasoned sapwood of hardwood stock will prevent attack:

(1) Inspect material in yards and storehouses at least annually, preferably in November and February, especially stock that is two

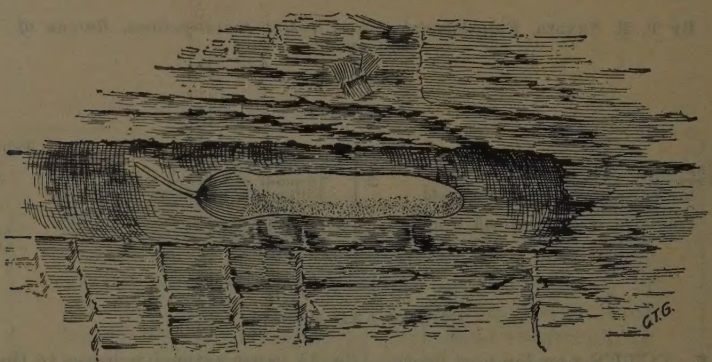

FIG. 2.—Egg of a powder-post beetle, *Lyctus planicollis*, in pore of wood on radial section of ash ladder-rung stock; pore opened to show egg. Highly magnified

or more years old, and remove for destruction or treatment (see pp. 6–11) all material, if any, showing evidences of powder-post attack.

(2) Burn all useless sapwood material and prevent the accumulation of refuse material in which the insects can breed.

(3) Classify, as far as possible, all dry or seasoned hardwood stock (*a*) by species or kinds, as hickory, ash, oak; (*b*) by quality, as heartwood, pure sapwood, part sapwood; and (*c*) according to age; that is, the number of years it has been seasoned. If the stock is thus classified only the sapwood piles need be handled and repiled in case of infestation—a saving of labor, time, and worry. The heartwood is not attacked and need not be inspected, and the piles of the older stock can be used first. (Fig. 10.)

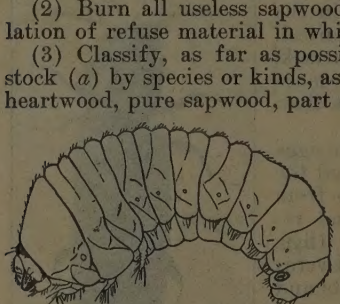

FIG. 3.—Larva of a powder-post beetle, *Lyctus cavicollis*. Enlarged. (Craighead and Böving)

(4) Utilize or sell first the oldest stock on hand. Prevent the accumulation of old stock; in other words, keep the stock moving.

(5) Where possible, utilize heartwood material, which is just as strong [1] and as suitable as the sapwood and is not attacked by Lyctus powder-post beetles. (Figs. 8 and 9.) Manufacturers are over-

[1] Exhaustive strength tests conducted by the Forest Service show that the heaviest, and consequently the strongest, hickory averages below 10 rings per inch in rate of growth, and that, weight for weight, red hickory (heartwood) is as strong as white hickory (sapwood).

coming the purely arbitrary trade prejudice for "whitewood" implement handles by painting all stock red. As a result, hardwood and sapwood are used indiscriminately and the paint protects the sapwood stock from subsequent attack by Lyctus beetles. Use only heartwood piling sticks in lumber piles.

(6) Inspect all new stock to prevent the introduction into lumberyards and storehouses of powder-posted material, and place any doubtful material in quarantine for several months' observation.

PROTECTIVE APPLICATIONS AND TREATMENTS

Linseed oil or coal-tar creosote.—If the beetles have not been eliminated from the yards and storehouses, stock that has been seasoned longer than eight months, and which is to be held in storage,

FIG. 4.—Powder-posted oak file case, showing exit holes of adult beetles; work of *Lyctus planicollis*

may be rendered immune by treatment with two coats of boiled linseed oil applied hot, or it may be immersed in vats of hot oil. The boiled oil will dry more rapidly than the raw linseed oil, especially if kerosene is added to the hot oil. The wood should be treated between October and March. Linseed oil has an advantage over other substances in that it can also be profitably applied to unseasoned timber, since it will prevent checking in seasoning. This oil stains the wood slightly yellow; in case of wagon stock, however, it can be used without prejudice to the trade and is an effective preventive. The standard coal-tar creosotes can be effectively used in case of stock to which the brown stain will not be undesirable or detrimental. The wood should be dipped in vats of hot creosote, or the preservative should be applied hot with a brush.

Fillers.—In the case of finished products or the more valuable material, any substance which closes the pores of the wood may be

effectively applied. For example, paraffin wax, varnish, shellac, lead paints, or other fillers, such as a mixture of resin and lampblack (as used on the ends of walnut gunstock blanks), which will also prevent season checking, effectively close the pores of the wood and prevent the beetles from depositing the eggs, which are laid in these pores. Thus the sapwood portions of backs and interior surfaces of cabinet work, inside finish, furniture, etc., should be treated to prevent attack, and such procedure will prove economical.

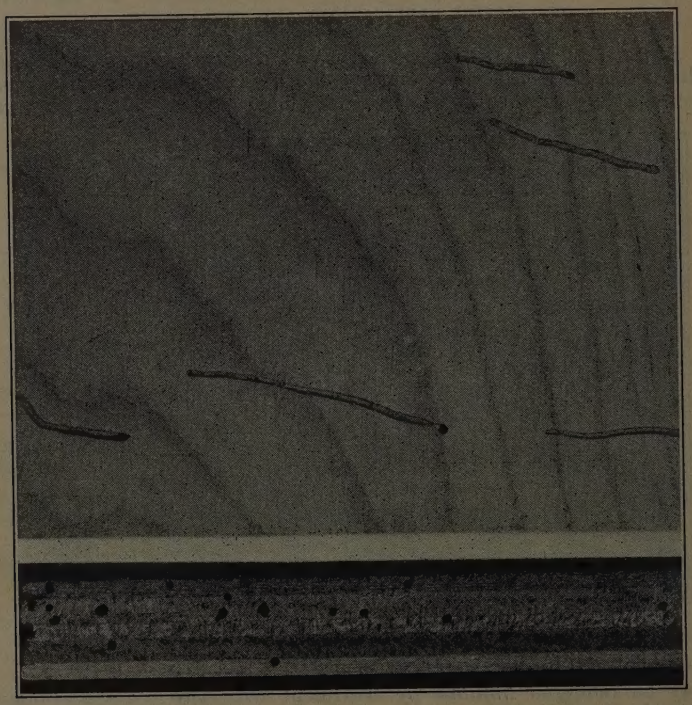

FIG. 5.—Lyctus powder-post damage to veneered 3-ply boards

Repellents.—It has been found that coal-tar creosote acts as a repellent to adult Lyctus powder-post beetles. Lumber, implement handles, wagon stock, etc., which can not be given a direct treatment with the creosote on account of the stain it leaves, can be protected by storage in sheds the woodwork of which has been treated with coal-tar creosote. Although it is advisable to construct new storage buildings of creosoted timbers, the interiors of buildings already constructed of untreated timbers can be sprayed with creosote. This spraying treatment will act as a repellent, but it can not be absolutely relied on if the products are to be stored for long periods. Valuable finished stock sprayed with orthodichlorobenzene will be

protected from attack, especially if in a closed shed, until the volatile chemical disappears; then the treatment must be repeated.

Submergence in water.—Submergence of sapwood hardwood material in water for periods of four months or longer leaches out or changes the food values in the cells, rendering the wood unfavorable to Lyctus powder-post beetles, so that it is not liable to subsequent attack.

Steaming under pressure.—Thorough steaming of wood for various periods at different pressures apparently so changes the wood that it is no longer suitable for Lyctus powder-post beetles. Tests conducted with white-ash boards steamed for 10 and 20 hours, respectively, at 28 pounds pressure, and for 17 hours at 45 pounds pressure, show that such treatments are effective in preventing attack. The wood is rendered darker in color by steaming, and in certain cases this might be disadvantageous.

FIG. 6.—Shoe-last blocks damaged by Lyctus powder-post beetles

REMEDIAL MEASURES

DISPOSAL OF INFESTED STOCK

After inspection of stock all infested material, including infested sap edges of lumber, etc., should be eliminated by sorting it out, trimming off or cutting away infested parts, and disposing of it by burning or otherwise. Such infested articles as may be tested for required strength and found to be of sufficient value after treatment

may be retained. Stock only slightly infested should be treated with kerosene oil or orthodichlorobenzene (pp. 6–10), or should be kiln dried (pp. 10–11), after which it should be kept in quarantine a sufficient length of time to determine whether or not a second treatment is required.

Such control work should be done between October and March 1 where the wood is in closed storehouses, and before April 1 where in the open. If thoroughly done and if by annual inspection thereafter infested material is disposed of as soon as found, there will soon be no trouble from powder-post beetles, unless there is a continued introduction in lumber and material received from other yards and localities where methods of control are neglected. To avoid this all material should be carefully inspected before shipment, or at least held in quarantine for observation before it is placed in the yards or storehouses.

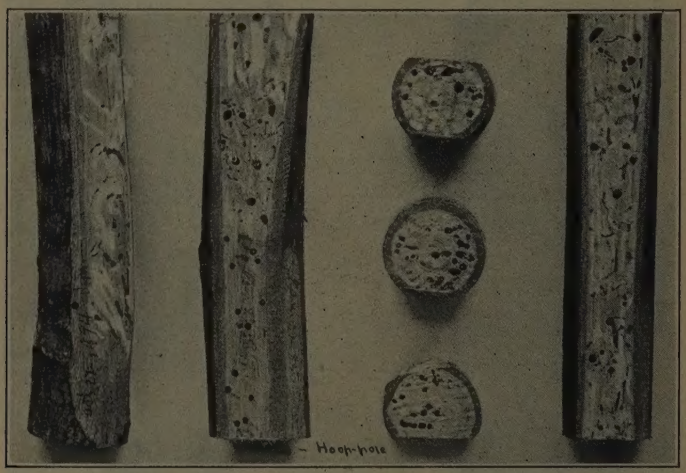

FIG. 7.—Hoop poles powder-posted by Lyctus beetles. Such thin stock seasons rapidly and may be attacked before it has seasoned for eight months

In the case of the more valuable stock, or where the removal of the infested parts is not practicable, the wood should be subjected, between October and March 1, to methods of treatment for the destruction of the insects. Of the following remedies the one most suitable should be selected in each case, it being remembered that the treatment must not be detrimental to the wood for subsequent uses.

KILLING THE INSECTS IN STOCK TO BE SAVED

Insecticides.—If there are large quantities of powder-posted stock these should be given liberal applications of pure kerosene oil or orthodichlorobenzene as a spray or with a saturated brush or mop, or the infested wood should be immersed in vats of kerosene. Several applications may be necessary. The only objection to kerosene is the fire risk. Kerosene soon evaporates, however, so that the

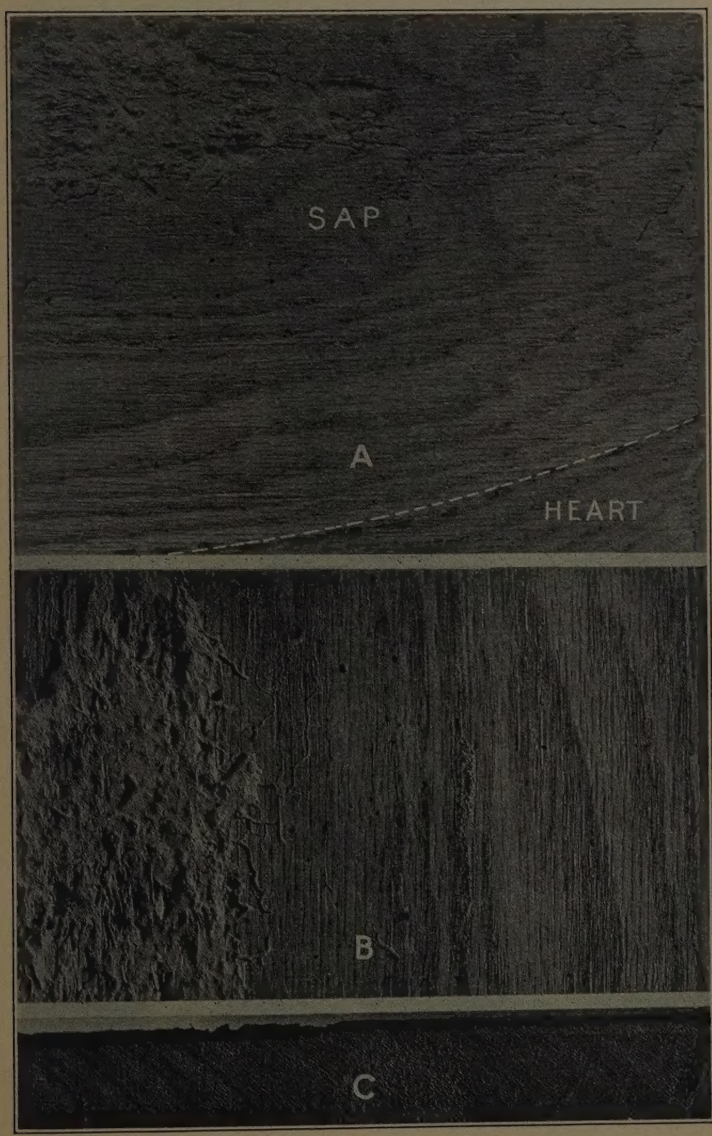

FIG. 8.—*A*, Oak sapwood powder-posted by *Lyctus planicollis* (note that the heartwood oak is not attacked); *B*, oak sapwood veneer (door stock) powder-posted by *Lyctus planicollis*; *C*, end view of same, showing uninfested chestnut core

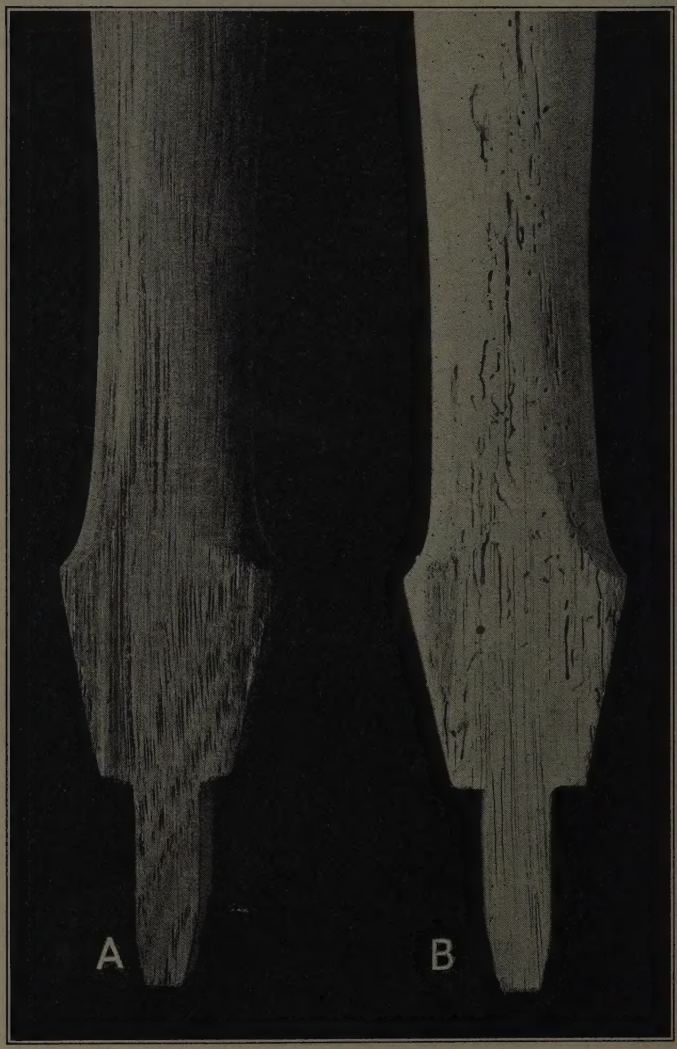

FIG. 9.—Two finished hickory spokes: *A*, Red heartwood, undamaged; *B*, whitewood, severely damaged; work of Lyctus powder-post beetles

FIG. 10.—*A* and *B*, Hickory billets piled in a yard in Kentucky, showing labor and time required to examine and repile large quantities of mixed stock where infestation exists, and, therefore, the necessity of piling heartwood and sapwood separately; *C*, infested sapwood hickory billets in a shed

treated material is not long near the danger point. Neither kerosene oil nor orthodichlorobenzene affects the subsequent application of shellac or varnish, although in the finishing process it is more difficult to stain kerosene-treated sapwood to match the rest.

Mixtures of 3 parts of coal-tar creosote and 1 part of kerosene oil,[2] of 3 parts of kerosene oil and 1 part of creosote (to obtain a deeper penetration), and of 1 part of creosote and 3 parts of naphtha have been used successfully in killing insects in infested stock. The wood should be dipped in vats of the mixture, preferably heated by coils of steam pipe, or the mixture may be applied hot with a brush. Of course, mixtures containing kerosene oil should not be heated over a direct fire.

In the case of powder-post damage to the timbers, interior woodwork, or furniture in buildings, the infested wood should be drenched with orthodichlorobenzene, a saturated rag or mop being used, or if brushing is impracticable, timbers should be sprayed with this liquid. Several applications may be necessary, and careful examination should be made after the treatment to determine if it has been successful.

If the borers are too deep in the wood, or if the wood is structurally weakened or rendered unsightly, it should be replaced with heartwood or softwood materials which are not attacked by Lyctus beetles.

If orthodichlorobenzene is used as a spray, it is advised that the house be opened up, since there is an odor to the chemical which may prove disagreeable in a closed room. Also, in spraying timbers overhead care should be taken not to let the liquid drip down, since it might slightly burn the face and hands and would be especially injurious if it got into the eyes.

Steaming.—Thorough saturation of the infested wood with live steam at a temperature of 135° F. in a kiln at atmospheric or higher pressure for one and one-half hours is an effective remedy. Steaming under high pressure, however, may weaken and discolor the wood and should not be applied to wood to be used for fine finish or where great structural strength is essential. The humidity should be at the saturation point.

Kiln drying.—Subjecting seasoned wood to a temperature of 180° F. in dry kilns is also an effective remedy. As Lyctus powder-post beetles are able to survive the commercial dry-kiln processes, it is necessary, in order to kill the larvæ in infested wood, not only to run the infested material through the ordinary process but at the end of this operation to have the temperature raised to 180° F. or over for a short period—one-half hour or longer, depending on the dimensions of the material. Such high temperatures may weaken the wood fibers, and should be used only where great strength is not needed in the utilization of the wood.

According to the Forest Products Laboratory of the United States Forest Service, under ordinary circumstances the mechanical properties of the wood will not be appreciably impaired by a temperature of 180° F. maintained for an hour. It will be necessary to keep up the humidity to a point at which no surface drying will take place.

[2] This mixture should be strained through burlap before it is used.

Such severe treatments have been used upon 5 by 7 inch wagon bolsters without deleterious effect upon their strength, and the Forest Products Laboratory frequently recommends, in the interests of good drying, that the stock be given a preliminary steaming or high-humidity treatment at temperatures considerably in excess of the initial drying temperatures. *Kiln-drying the sapwood of hardwoods will not prevent subsequent attack by Lyctus beetles.*

Fumigation.—Fumigation of infested wood in tightly closed drying rooms with the fumes of sulphur at the time of the emergence and flight of the adult beetles is recommended *only* for killing the adult beetles and preventing egg laying.

INSECT PARASITES, PREDATORY ENEMIES, AND SCAVENGERS OF LYCTUS BEETLES

Although several species of parasitic [3] and predatory [4] insects attack Lyctus powder-post beetles, they can not ordinarily be depended upon to keep these destructive beetles under control. Small wasplike parasites have been reared in large numbers year after year from wood in quantity infested by Lyctus powder-post beetles and confined in large breeding cages, yet the numbers of the beetles did not seem to be markedly reduced, even though no hyperparasites (parasites of the parasites), which if present would have interfered with the work of the beneficial parasites, were reared. Parasites and adult Lyctus beetles continued to emerge in numbers from the infested wood for from 4 to 10 years. It would seem that such conditions of confinement should render the parasites more effective than under natural conditions in the open. Both the Lyctus beetles and the parasites gradually decrease in size, after many years of such breeding.

Not to be confused with these beneficial parasitic and predatory insect enemies of Lyctus powder-post beetles, although often found with them, are certain insects which act as scavengers.[5]

SUMMARY

Powder-post beetles often ruin stored hardwoods of the finest quality by turning them into a flourlike powder. They work in whitewood or sapwood, especially second-growth hickory, ash, and oak, which has been stored or piled in one place for two or three years or longer. They are attacked by parasitic and predatory insects, but these can not be depended upon to keep them in control.

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[3] According to S. A. Rohwer, entomologist, in charge of taxonomic investigations, Bureau of Entomology, to whom the many species of wasplike parasites that have been reared were submitted for identification, a braconid, *Hecabolus lycti* Cress., is undoubtedly the predominating parasite of the common southern Lyctus beetle (*Lyctus planicollis* Lec.), and has been reared in enormous numbers from wood infested by this species. Several other species of braconid parasites of Lyctus beetles, however, have been reared in quantity.

[4] A very effective predatory enemy of Lyctus beetles is the clerid beetle *Tarsostenus univittatus* Rossi, which has been reared from wood infested with the southern Lyctus beetle (*Lyctus planicollis* Lec.). The larvæ of this clerid prey on the Lyctus larvæ, and the adult clerid beetles rapidly pursue and devour the adults. The adults of this clerid resemble the adult Lyctus beetles, especially the large female spotted with powder from infested wood. There are also many other insect enemies, such as the histerid beetle *Teretriosoma americanum* Lec.

[5] Among the scavengers are a wingless psocid (*Troctes divinatoria* Müll.), a dermestid beetle (*Trogoderma inclusum* Lec.), and among the cucujid beetles *Silvanus surinamensis* L. (the cadelle) and species of Laemophloeus.

Sapwood seasoned for less than 8 or 10 months will not be attacked,[6] and heartwood is never attacked and should be utilized wherever possible.

By the adoption of a system of inspection, classification, and proper disposal of the seasoned sapwood of hardwood stock, loss by powder-post beetles can be prevented.

Inspect material in yards and storehouses annually, preferably in November and February, and sort out and burn material showing evidence of powder post. Burn all refuse and useless sapwood material.

Classify seasoned hardwood stock into hickory, ash, oak, etc.; heartwood, pure sapwood, and part sapwood; and according to the number of years seasoned.

Utilize or sell oldest stock first; it is most liable to attack.

Inspect all new stock to prevent introduction of powder-posted material. If there is doubt as to whether or not it is infested, place it in quarantine for several months.

Use only heartwood piling sticks in lumber piles.

To prevent attack, treat the more valuable material, between October and March, with boiled linseed oil. Varnish or paraffin the sapwood portions of backs and interior surfaces of cabinet work, inside finish, and furniture. Stock that has been submerged in water for four months or longer will not be liable to attack.

Material once attacked is usually damaged beyond repair. If the injury is not too far advanced, however, further damage can be stopped by trimming off infested edges and saturating the wood with kerosene or orthodichlorobenzene. Kiln drying at a temperature of 180° F., or steaming with a saturated atmosphere for one and a half hours at a temperature of 135° F., will destroy all stages of Lyctus powder-post beetles in the wood.

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[6] Very thin stock, such as hoop strips (fig. 7) for barrels, etc., may be attacked before this period because of more rapid seasoning.

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